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ABSTRACT

Groups of subjects were placed in a room in which their personal space was violated or not violated. Some subjects were told that subliminal noise would be played into the room and that noise would either arouse or relax them. (Actually there was no noise.) Other subjects were told nothing about subliminal noise. The subjects worked on a number of tasks and were then asked to report how crowded they felt. An interaction between the two variables was obtained such that the explanation had no effect on subject's performance nor the reported crowding when their personal space was not being violated. However, when there was a violation of personal space, subjects who felt the noise would arouse them reported being less crowded and performed better than subjects in the relaxing noise or no explanation conditions. It was reasoned that subjects attributed the arousal caused by the personal space violation as being caused by the "arousing" noise and thus, they felt less crowded than when they could not attribute arousal as being caused by the noise. These results support the theory that crowding is a function of violation of personal space and attribution about the cause of arousal created by the violations. (Author)

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The Role of Attribution in the Experience of Crowding

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Running head: Attribution and Crowding

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Abstract

The theory that the experiencing of crowding results through an attribution of arousal process was examined. Specifically, it was predicted that subjects who were aroused by having their personal space violated would experience less crowding if they were led to believe that some other environmental factor was responsible for the arousal. However, giving subjects an alternative explanation for arousal should not affect their experience of crowding if they were not actually aroused by violations of their personal space. Groups of subjects were placed in a room in which their personal space was violated or not violated. Some subjects were told that subliminal noise would be played into the room and that noise would either arouse or relax them. (Actually there was no noise.) Other subjects were told nothing about subliminal noise. The subjects worked on a number of tasks and were then asked to report how crowded they felt. An interaction between the two variables was obtained such that the explanation had no effect on subject's performance nor the reported crowding when their personal space was not being violated. However, when there was a violation of personal space, subjects who felt the noise would arouse them reported being less crowded and performed better than subjects in the relaxing noise or no explanation conditions. It was reasoned that subjects attributed the arousal caused by the personal space violation as being caused by the "arousing" noise and thus, they felt less crowded than when they could not attribute arousal as being caused by the noise. These results support the theory that crowding is a function of violation of personal space and attribution about the cause of arousal created by the violations.

The Role of Attribution in the Experience of Crowding

Since Calhoun (1962) reported the alarming effects of high density on a population of white rats, interest in the effect of crowding on humans has burgeoned. While the methodology of much of the laboratory research on crowding appears to be quite similar the results obtained from these studies have been surprisingly varied. For example, Freedman, Klevansky and Ehrlich (1971) found neither decrements in performance nor increases in interpersonal hostility when comparing crowded groups to uncrowded groups. Stokols, Rall, Pinner and Schopler (1973) also failed to find that variations in density affected group performance. On the other hand, Epstein and Karlin (1975), Freedman (1975), and Griffitt and Veitch (1971) reported that males become more competitive and aggressive under high density as opposed to low density conditions.

These contradictory findings led a number of investigators (Altman, 1975; Lawrence, 1974; Loo, 1972; Stokols, 1972) to point out that there is confusion surrounding the concept of crowding and to lament the fact that there is no unified theory from which to predict the effects of crowding. In an attempt to clarify some of the confusion Stokols (1972) suggested that while crowding does have a spatial component (density), it is a complex term that encompasses more than simple density. According to Stokols, crowding is a psychological state rather than a simple spatial measure. While there is agreement that

density and crowding are distinct and that crowding does involve a psychological component (e.g., Altman, 1975; Freedman, 1975; Sundstrom, in press) , there are still questions about exactly what constitutes crowding and why it affects human behavior.

Worchel and Teddlie (1976) offered a two-factor theory of crowding identifying violations of personal space (e.g., Hall, 1966) as the spatial variable associated with crowding and attribution as the process through which the experience of crowing results. Specifically, they suggested that an individual becomes aroused when his personal space is violated. Once aroused, the individual scans the environment to determine an explanation for the arousal. If the cause of the arousal is attributed to others being physically too close, the individual will experience the state of crowding. Once the individual experiences crowding he will attempt to reduce it since it is experienced as a negative state.

Elaborating further on the theory, it is now suggested that the experience of crowding will result in a decrement in performance on some tasks and also result in interpersonal hostility. These negative effects occur because once the individual determines that he is "crowded," he will focus attention on alleviating this state. Thus, the individual will not be able to devote his total efforts to the task performance and the result is likely to be that performance, especially performance of complex tasks, is likely to suffer. Further, when focusing on reducing the experience of crowding, a salient cognition

becomes the fact that other people in the environment are causing the individual to "feel crowded" and, in some cases, frustrating attempts to reduce crowding. This process is likely to lead to hostility directed toward these other persons.

The theory also offers a number of means for reducing the experience of crowding without increasing the actual physical space available to individuals. For example, there is evidence that appropriate interpersonal distances are greater in frontal approaches than approaches from the rear (e.g., Horwitz, Duff & Stratton, 1964; Sommer, 1962). This suggests that crowding can be reduced by placing individuals back-to-back in a room as opposed to placing them facing each other. Kutner (1973), in fact, found that such a technique does reduce the experience of crowding.

A potentially more flexible means of reducing crowding can be hypothesized by focusing on the attribution process of the theory. That is, it should be possible to reduce the experience of crowding by interfering with the attribution process associated with crowding either by making other people in the environment less salient or by giving individuals an alternative source onto which they can misattribute the cause of their arousal. Such a situation naturally occurs at a basketball game where the individual may be aroused by having his personal space violated but may not experience crowding because he misattributes his arousal as being caused by the basketball game itself. Thus, simple restructuring of the environment may reduce crowding without the necessity of reducing spatial density.

In addition to making predictions about the causes, results of, and means for reducing the experience of crowding, the present approach can also explicate some previously reported results. One of the most perplexing is the differential effects crowding has on male and female subjects. A number of investigators (Freedman, 1975; Stokols et al, 1973) have found that male subjects are more severely affected by crowding than female subjects. According to the present position, a potential explanation for this effect can be garnered by focusing on the personal space theories (e.g., Hall, 1966; Evans & Howard, 1973) that suggest that females have a closer personal space distance than males. That is, females are more comfortable interacting at a closer distance than males. It follows that if density or personal space is kept constant, it is more likely that the appropriate spacing for males will be violated than that for females. If personal space is the spatial variable associated with crowding, then males should be more likely to experience crowding at a given density than females.

While the present theory can offer post hoc explanations for previous findings and can make additional predictions, the theory has not been adequately tested. In an initial test Worchel and Teddlie (1976) provided supportive data demonstrating that interaction distance (personal space) rather than density was the spatial measure associated with the experience of crowding. In explicating this portion of the theory they orthogonally manipulated interaction distance and density. They also attempted

to demonstrate the necessity of the attribution phase of the theory. In half the conditions, pictures were placed on the walls of the experimental room while in the other half of the conditions, the walls were bare. They reasoned that the pictures would inhibit the attribution of crowding in the conditions where the subjects would be aroused (close interpersonal distance) by redirecting the focus of individuals. As predicted, manipulations of interaction distance significantly affected the experience of crowding, interpersonal attraction, and task performance while manipulations of simple density had few effects. Also, the pictures reduced the experience of crowding only in the close interpersonal distance condition.

While the results offer evidence for the importance of personal space in the experience of crowding, there is some question about the definitiveness of the demonstration of the attribution phase of the theory. It is possible to argue that the pictures had little to do with the attribution of crowding but that they simply distracted the individuals from concentrating on the situation at hand. Because the subjects were distracted and spent less time looking at other subjects, they reported feeling less crowded. While there was evidence in the study to suggest that this simple distraction process was not solely responsible for the reduction in crowding, it can still be argued that the results did not clearly demonstrate the attribution process postulated by the theory.

The major aim of the present experiment was to offer clearer evidence that the experience of crowding results through an

attributional process much like that involved in the self-attribution of other emotions (e.g., Schachter & Singer, 1962). Schachter (1964) postulated that once an individual is physiologically aroused, he searches his environment for cues that define the nature of the arousal. These cues help define the qualitative factor of the emotion that the individual will experience. Drachman and Worchel (1976), Storms and Nisbett (1970), and Zanna and Cooper (1973) showed that an individual can be made to misperceive the type of emotion he is experiencing by misrepresenting the environment to the individual and placing "false" external cues in the environemnt. Zanna and Cooper found that the experience of cognitive dissonance can be reduced by having the individual take a pill that will supposedly arouse him before working on a dissonance-producing task. The arousal created by the dissonance-producing task is attributed to the pill and consequently the individual fails to experience cognitive dissonance.

In an effort to demonstrate the attribution process associated with crowding, a similar method was employed. Individuals were either aroused or not aroused by having their personal space violated by other subjects. In some cases they were told that subliminal environmental conditions (subliminal noise) might cause them to experience arousal. In other conditions they were told that the subliminal conditions should calm (rather than arouse) them or they were told nothing about subliminal conditions. It was expected that if attribution is involved in the experience of crowding, subjects who were aroused by having their personal

space violated and who could attribute this arousal as being caused by other sources (arousing subliminal noise) would experience less crowding than subjects who did not have this external factor onto which they could attribute the arousal. The arousing noise explanation should not reduce the experience of crowding in individuals who did not have their personal space violated since they would not be motivated to seek external cues to explain their arousal. It was further expected that interpersonal attraction indices and task performance would decrease as the individual's experience of crowding increased.

A final aim of the present study was to investigate whether or not there are sex differences in the experience of, or reactions to, crowding. Some previous research has reported differences but the personal space of females in these studies may not have been severely violated. Care was taken to insure that the personal space of females as well as males was violated in the present study.

Method

Subjects

Three hundred twenty-five male and female introductory psychology students participated in a study entitled "Group Performance" in partial fulfillment of a course requirement. Same-sexed groups of five previously unaquainted subjects comprised each group. One group of subjects was deleted from the analysis because one subject in the group chose to sit on the floor during the experiment.

Procedure

Subjects were greeted by the experimenter as they arrived

to the experiment and ushered into a large waiting room filled with chairs and a large table covered with electronic amplifiers and recording equipment. Subjects spent a minimum of five minutes as a group in the waiting room in full view of the equipment. The experimenter then led the group into an adjacent room (8ft. 9in. by 9ft. 10in.) which was bare except for a small "transmitter" in a corner and a circle of five armless chairs surrounding a microphone hanging from the ceiling in the center of the room. The subjects were instructed to sit down in the chairs and not to move them because the experiment was being taped and the chairs had been placed carefully so as to assure optimum recording quality.

Interpersonal distance was manipulated by varying the distance between the chairs. In the Far Interpersonal Distance condition the front legs of adjacent chairs were spaced 20in. apart. In the Close Interpersonal Distance condition the front of each chair touched the two adjacent chairs.

Once the subjects were seated, the experimenter explained that the study was aimed at studying group performances under varying types of subliminal stimuli. He told subjects that in everyday life individuals are often bombarded by stimuli that they are not conscious of but which may affect their behavior. He gave them the example of ultraviolet sun rays which are not detectable but which may affect behavior. The experimenter explained that the present study was aimed at studying the effects of subliminal noise on performance. In the Arousing Explanation condition the experimenter told subjects that

subliminal noise would be played into the room while they worked on the assigned tasks. This noise would be undetectable to the naked ear but previous studies had shown that this noise may cause individuals to feel somewhat stressed and uncomfortable. In the Relaxing Explanation condition subjects were also told that undetectable noise would be played into the room but that previous research had shown that this noise tended to relax and calm individuals. A No Explanation condition was run in which subjects were told nothing about subliminal noise or its affects on individuals. They were simply told the experiment was studying group performance and intragroup interactions. Actually, the sound generators emitted no sound whatsoever into the experimental room for any of the conditions.

Following the introduction the experimenter explained the first task. He told subjects that they were to derive as many words as possible from the master word "OBSERVATIONALLY." The group members were to work on a single group list in the time allotted by the experimenter. Assured that everyone understood the instructions, the experimenter left the room and allowed 10 minutes for the task. When the experimenter returned the word list was collected and the second task was introduced.

The second task involved the group deciding on the treatment of a juvenile offender named Johnny. Each subject was given a case history that described a young teenager who had had a number of encounters with the law for minor violations such as shooting out street lights. It also stated that he came from a broken home and his mother had difficulty controlling him. The

question posed to subjects was what treatment should be applied to Johnny. A list of seven alternative treatments which ranged in severity of punitiveness from very benevolent to very malevolent accompanied the case history. Subjects were told to read the case and then decide as individuals what treatment should be applied to Johnny. After they had made their individual decisions, they were told to discuss the case and arrive at a group consensus treatment. After the group had completed the decision process the experimenter returned to the room and recorded the group decision.

The subjects were then asked to respond to a twenty-item questionnaire designed to evaluate their individual reactions to the experiment, the experimental room, and fellow group members. The experimenter again left the room, allowing the subjects five minutes to complete the questionnaire. When the experimenter returned, the responses were collected and subjects were carefully debriefed.

Results

Because subjects were run in groups and the data within groups could not be completely independent, group means were utilized as the unit of analysis. The data were first analyzed using sex of subject as a variable. Thirty-three groups of male and thirty-two groups of female subjects were run. The analysis yielded no significant effects for the sex manipulation and, therefore, the data were collapsed across the sex variable.

Arousal

In order to determine if the interpersonal distance manipulation did create stress, subjects were asked to rate how "ill-

at-ease" they felt during the experiment. As can be seen by

Insert Tables 1 and 2 here

Tables 1 and 2, two main effects resulted indicating subjects were significantly more stressed in the Close than Far interpersonal distance condition and more stressed in the Arousing Explanation condition than in the Relaxing or No Explanation conditions. This latter effect is particularly interesting to note as it indicates that the simple expectation of arousal led subjects to report being more aroused in the Arousing Explanation conditions. The marginal interaction was caused by a greater increase in reported stress in the Arousing-Far condition than in the Arousing-Close condition. Thus, these data show that the interpersonal distance manipulation and the explanation manipulation affected self-reports of stress.

Crowding Measures

Two questions were used to measure subject's experience of crowding. Subjects were asked how crowded and confined they felt during the experiment. Since subjects responded similarly to both questions, the ratings were combined to form a single "crowding" index. As can be seen by the results presented in

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Insert Tables 3 and 4 here

Tables 3 and 4, two main effects indicate that subjects felt more crowded in the Far as opposed to the Close interpersonal

distance conditions and more crowded in the Relaxing or No Explanation conditions than in the Arousing condition. These main effects were qualified by a significant interaction ($F(2,58) = 43.48$, $p < .001$). The explanation had no effect on the reported crowding in the Far interpersonal distance condition. However, in the Close interpersonal distance condition, subjects in the Arousing condition felt significantly less crowded than subjects in either the Relaxing condition ($F(1,58)=115.29$, $p < .001$) or the No Explanation condition ($F(1,58)=97.67$, $p < .001$).

Task Performance

The measure of task performance was the number of words groups formed from the master word. As can be seen from Tables 5 and 6, subjects performed better in the Far than Close con-

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Insert Tables 5 and 6 here

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dition. There was also a significant interaction ($F(2,58) = 3.58$, $p < .05$) similar to that found with the crowding measure. The explanation manipulation created no significant ($F < 1$) differences within the Far condition. However, subjects in the Close-Arousing condition performed significantly better than subjects in the other two Close conditions ($F(1,58) = 7.74$, $p < .01$). In fact, there was not a significant difference in the performance of subjects in the Arousing-Close and Arousing-Far conditions ($F(1,58) = .57$), p = n.s.).

Interpersonal Attraction

Subjects were asked to rate how friendly and likeable their fellow group members were and these ratings were combined to

form an interpersonal attraction index. The interpersonal attraction scores followed closely the pattern found on the task performance. As shown by Tables 7 and 8, subjects in the Far condition were signifi-

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Insert Tables 7 and 8 here

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cantly more attracted (1 = lowest attraction, 10 = highest attraction) to fellow group members than subjects in the Close condition (Far $\bar{X}$ = 8.41, Close $\bar{X}$ = 7.64; $F(1,58) = 43.90$, $p < .001$). There was also a significant interaction ($F(2,58) = 8.26$, $p < .001$) indicating that while the explanation manipulation did not affect attraction in the Far condition, subjects in the Arousing-Close condition were significantly more attracted to group members than subjects in the Relaxing-Close condition ($F(1,58) = 14.50$, $p < .001$) and No Explanation-Close condition ($F(1,58) = 10.00$, $p < .001$).

Punitiveness

Subjects were asked to individually determine the treatment for Johnny (1 = most benevolent, 7 = most malevolent). Results of these individual ratings indicated that subjects in the Far condition were more lenient on Johnny than subjects in the Close condition (Far $\bar{X}$ = 2.07, Close $\bar{X}$ = 2.49; $F(1,58) = 19.36$, $p < .001$). There was also a marginally significant interaction ($F(2,58) = 2.76$, $p < .08$) indicating that the explanation had no effect on ratings in the Far condition but that subjects in the Close-Arousing condition were more lenient than subjects in the other two Close conditions ($F(1,58)=6.25$, $p < .05$).

The groups also arrived at group consensus ratings for Johnny. It was expected that the same pattern of results obtained in the individual ratings would be obtained with the group consensus ratings. However, there were no differences

among any of the group consensus ratings as all but one group arrived at the same rating (treatment program 2).

Discussion

The results of the present study support the hypothesis that crowding is experienced through an attributional process whereby the individual becomes aroused by violations of personal space and then searches the environment to determine the cause of this arousal. If the cause of the arousal is not attributed to the violations of appropriate space, crowding will not result. The support for this contention is based on the subject's report of crowding and the interaction between the spacing and explanation factors on crowding reports. Informing subjects that environmental factors would arouse them did not reduce their experience of crowding when their personal space was not violated by others. In fact, this information tended to make them feel somewhat more crowded. However, when their personal space was violated, this alternative explanation for arousal significantly reduced the experienced crowding. Supposedly, subjects in the aroused conditions attributed the cause of their arousal to the subliminal noise and, therefore, felt less crowded.

It is interesting to note that the explanation affected the experience of crowding and the reports of arousal in different ways. When subjects were told that the subliminal noise would arouse them, they reported feeling more ill-at-ease than when they were not told of the noise effects or were told that the noise would calm them. This occurred even when their personal space was being violated. However, at the same time that the "arousing noise" was making them feel more ill-at-ease, it was

also reducing their experience of crowding in the Close interpersonal distance condition. This finding is extremely important for the present theoretical position as it demonstrates that the label of crowding can be independent from the arousal that an individual might feel. Thus, the actual experience of crowding does seem to be a cognitive process that can be affected by environmental factors other than simple arousal.

Another effect of theoretical importance involves the task performance and interpersonal attraction scores. Both of these behaviors were more affected by the crowding attribution data than by the perception of arousal or stress. That is, performance and interpersonal attraction increased as subjects reported feeling less crowded. And in the conditions where personal space was violated, there was an increase in performance and interpersonal attraction despite the increasing feelings of being ill-at-ease in the Arousing Explanation condition. These results are congruent with the hypothesis that the attribution of crowding causes the individual to turn his attention to reducing his uncomfortable condition and the redirection of attention necessary for this effort results in reduced performance.

In addition to being theoretically important, these results have implications for the applied setting. They suggest that performance and interpersonal attraction may be enhanced by altering the individual's perception of his environment without directly reducing the stress involved in such environment or altering the environment. Attributions about crowding seem to be rather plastic and can be molded by either redirecting the

individual's focus (Worchel & Teddlie, 1976) or by giving the individual "explanations" for arousal. Conversely, it can be implied that performance and attraction will not necessarily be enhanced by moderate reductions in the stress associated with a rather dense environment if the individual's focus is still placed on the violations of his personal space. In this case, the individual will still feel "crowded" and this feeling will inhibit performance and adjustment to the environment.

Another result of interest is the failure to find sex differences in the present study. A number of previous studies reported such sex differences and such differences are not consistent with the present theoretical framework. It was suggested that one possible reason for these sex differences was the possibility that the personal space of females in some of the previous work was not severely violated. Care was taken to insure that such violations occurred in the present study and the result was no differences in the responses of male and females subjects. While caution must be exercised in extrapolating from failure to find differences, it does suggest that females do experience crowding and respond to it in a manner similar to males. It may, however, take closer interpersonal distances before females will feel stressed and experience crowding.

In sum, the present results support a two-factor theory of crowding that suggests that individuals become aroused by violations of their personal space and experience crowding only when they make the attribution that their arousal is being caused by these violations. Further, task performance and interpersonal attraction are affected by the attributions the individual makes

about his experience rather than the amount of arousal he may feel.

While the present results help clarify the process by which an individual experiences crowding, there are some interesting questions left unanswered. One such question deals with the factors that determine whether or not the individual will attribute his arousal to violations of personal space or to an alternative source. It can easily be predicted that when no plausible outside source exists, the individual will attribute arousal to personal space violations and will experience crowding. However, when a plausible alternative explanation exists, what is the factor that determines where the attribution for the cause of arousal will be made? Is the determining factor salience of the cue or is it the amount of threat involved in the alternative explanation. For example, in the present study, attributing the cause of arousal to subliminal noise enabled the individual not to blame other members of his group for causing him to feel uncomfortable. Thus, it because easier to deal with these other members and therefore the noise explanation was less "threatening" than the "crowding" explanation. Another question involves the time factor. Does the attribution of arousal to an alternative source such as the subliminal noise serve to permanently reduce the crowding experience in the situation or does it simply delay the experience of crowding? These and other questions must be answered by further research on the experience of crowding.

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Table 1

Means for Stress Index

Interpersonal Distance	Arousing	Relaxing	No Explanation
Close	6.86 (11)	5.93 (11)	5.85 (12)
Far	4.26 (10)	2.44 (10)	2.60 (10)

Note. Number in parentheses indicates number of groups per cell. Subjects were asked how relaxed or ill-at-ease they felt during the experiment; 1 = relaxed, 10 = ill-at-ease.

Table 2

Analysis of Variance for Stress Index

Source	df	F
A (interpersonal distance)	1	364.86*
B (noise explanation)	2	29.86*
A X B	2	2.67
Error	58	.42

*$p < .001$

Table 3

Means for Crowding Indices

Interpersonal Distance	Arousing	Relaxing	No Explanation
Close	4.26	7.10	6.68
Far	3.36	2.67	3.11

Note. Scores are formed by a mean rating of how crowded and how confined subjects reported feeling; 1 = not at all crowded, 10 = very crowded, 1 = very unconfined, 10 = very confined.

Table 4

Analysis of Variance for Crowding Indices

Source	df	F
A (interpersonal distance)	1	373.25*
B (noise explanation)	2	26.72*
A X B	2	45.99*
Error	58	.37

*$p < .001$

Table 5

Performance on Word Task

Interpersonal Distance	Arousing	Relaxing	No Explanation
Close	85.91	74.00	77.92
Far	89.40	93.50	91.80

Note. Number represents number of words groups made from master word "observationally."

Table 6

Analysis of Variance for Word Task Performance

Source	df	F
A (interpersonal distance)	1	25.10**
B (noise explanation)	2	1.06
A X B	2	3.58*
Error	58	96.55

*$p < .05$

**$p < .001$

Table 7

Mean Attraction Ratings for Other Group Members

Interpersonal Distance	Arousing	Relaxing	No Explanation
Close	8.10	7.34	7.47
Far	8.25	8.64	8.31

Note. Scores are formed by a mean rating of how much they liked fellow group members and how friendly they perceived them to be; 1 = not like, 10 = liked very much, 1 = not friendly, 10 = very friendly.

Table 8

Analysis of Variance for Attraction Ratings of Other Group Members

Source	df	F
A (interpersonal distance)	1	43.55*
B (noise explanation)	2	2.31
A X B	2	8.17*
Error	58	.22

*$p < .001$